Application Note

Basic application board of the TEA5594 AM/FM radio IC

J. Been

Radio Section
Customer Support Group, Consumer ICs, Nijmegen – The Netherlands

Keywords
one chip radio
electronic tuning
PCB layout
alignment procedure

Report No : NBA/AN9012
Date : January 1991
Pages : 13

© Philips Export B.V. 1990
All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

PHILIPS

PHILIPS

Abstract:

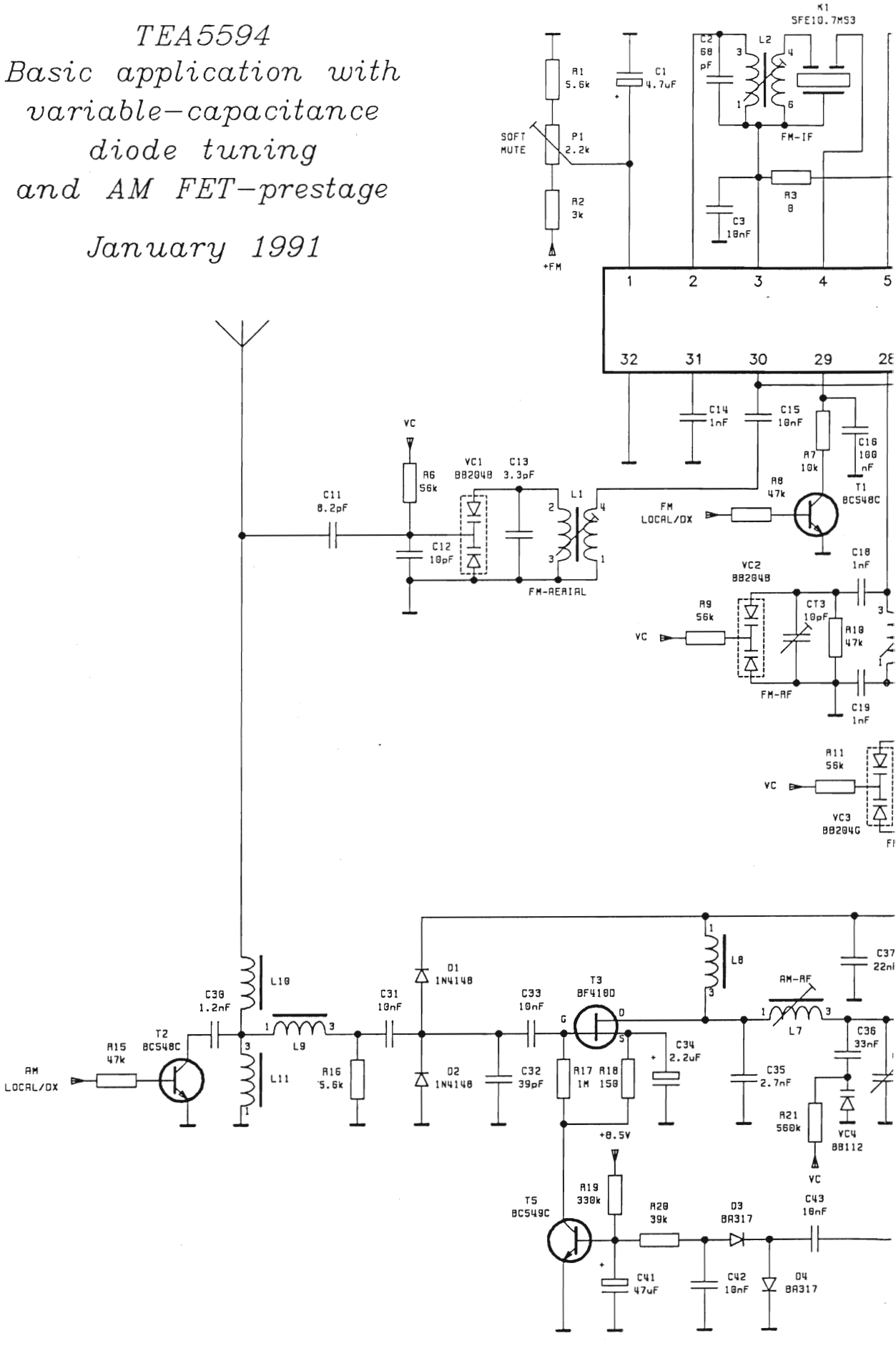
This report is a supplement to the earlier application note "TEA5594 in AM/FM Electronic Tuned Car-radios" (ERA/AN90002).
It presents the basic application circuit diagram with a PCB proposal.
A few changes are made in the scheme compared to the earlier note. The main ones are the values of the resistors at pin 1 (mute input) and an extra 3.3 pF capacitor in the FM aerial input LC resonator. Also R13 and R3 have different values. To improve compliance to the CENELEC outband immunity requirements, C16 is increased to 100 nF and the FM RF amplifier biasing is minimised by use of a 1.8 kΩ resister between pins 27 and 30. The performance is given on page 8.
The PCB layout has been adapted to achieve a better performance. We stress here that this print is a prototype. A more representative version will be published in the near future.
Next, the report presents the main AM and FM curves measured on the basic application PCB. The output noise, audio output level, DC level indicator output and THD are plotted as a function of the input signal level.
The report also gives an alignment procedure for the basic application circuit. The PCB we offer to the customer is aligned in accordance with this description.
Finally a parts list is presented.

Table of Contents: page

1. Basic application circuit diagram 3
2. Component side Application PCB 4
3. Track side Application PCB 5
4. AM performance at 1 MHz 6
5. FM performance at 100 MHz 7
6. FM CENELEC 'outband AM on FM' 8
7. Alignment procedure 9
8. Parts list 11

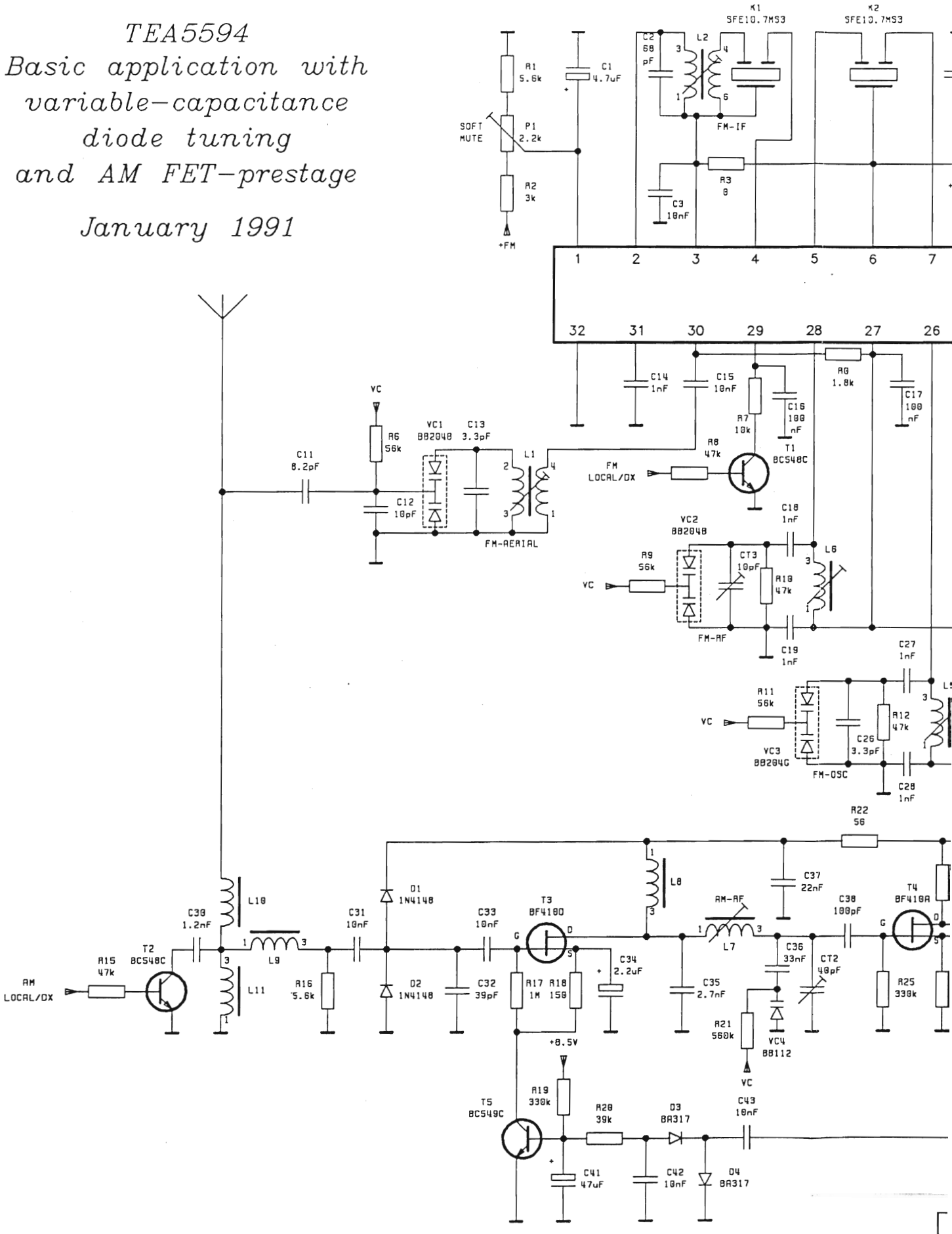
TEA5594
Basic application with variable-capacitance diode tuning and AM FET-prestage

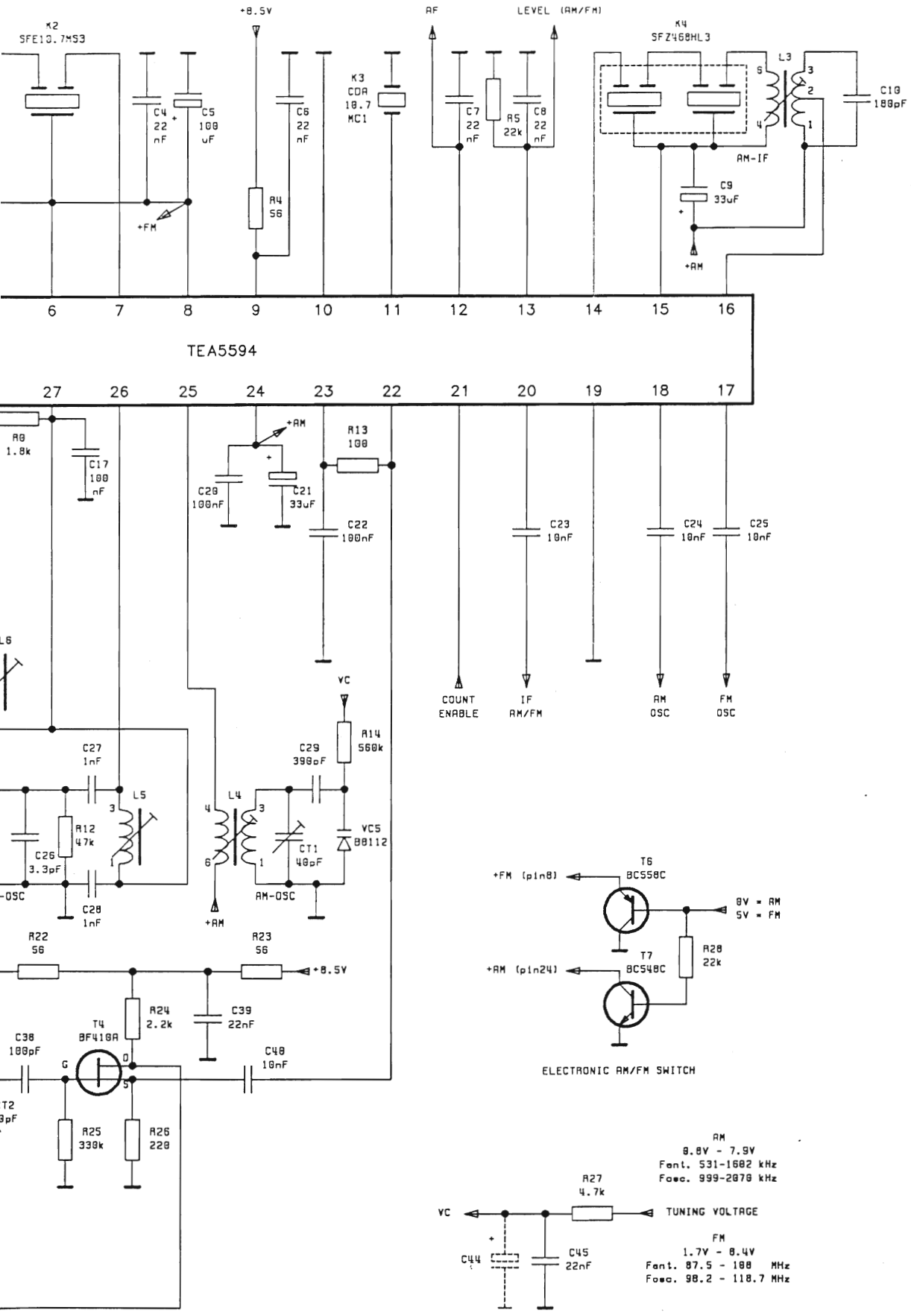
January 1991

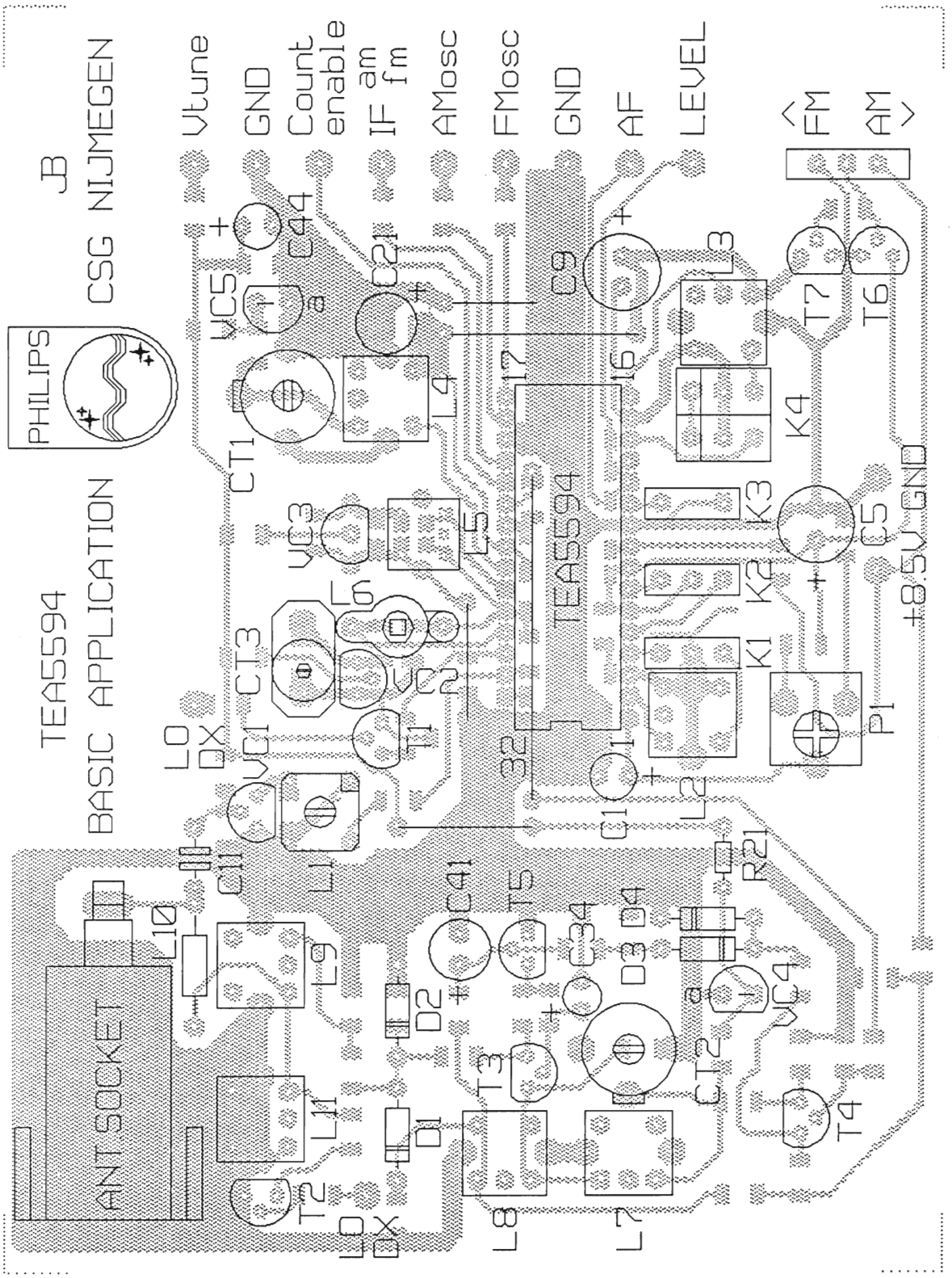


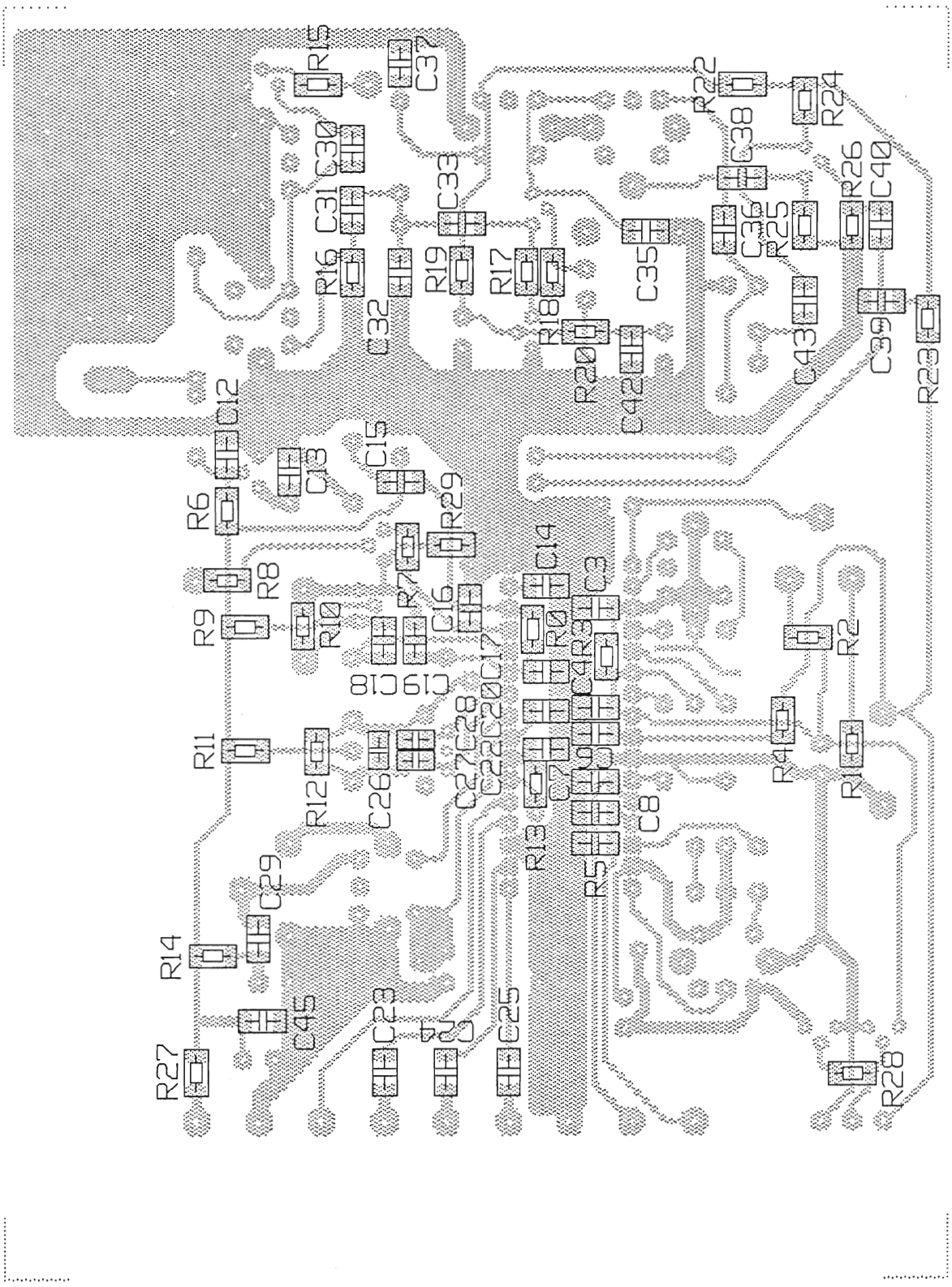
TEA5594
Basic application with variable-capacitance diode tuning and AM FET-prestage

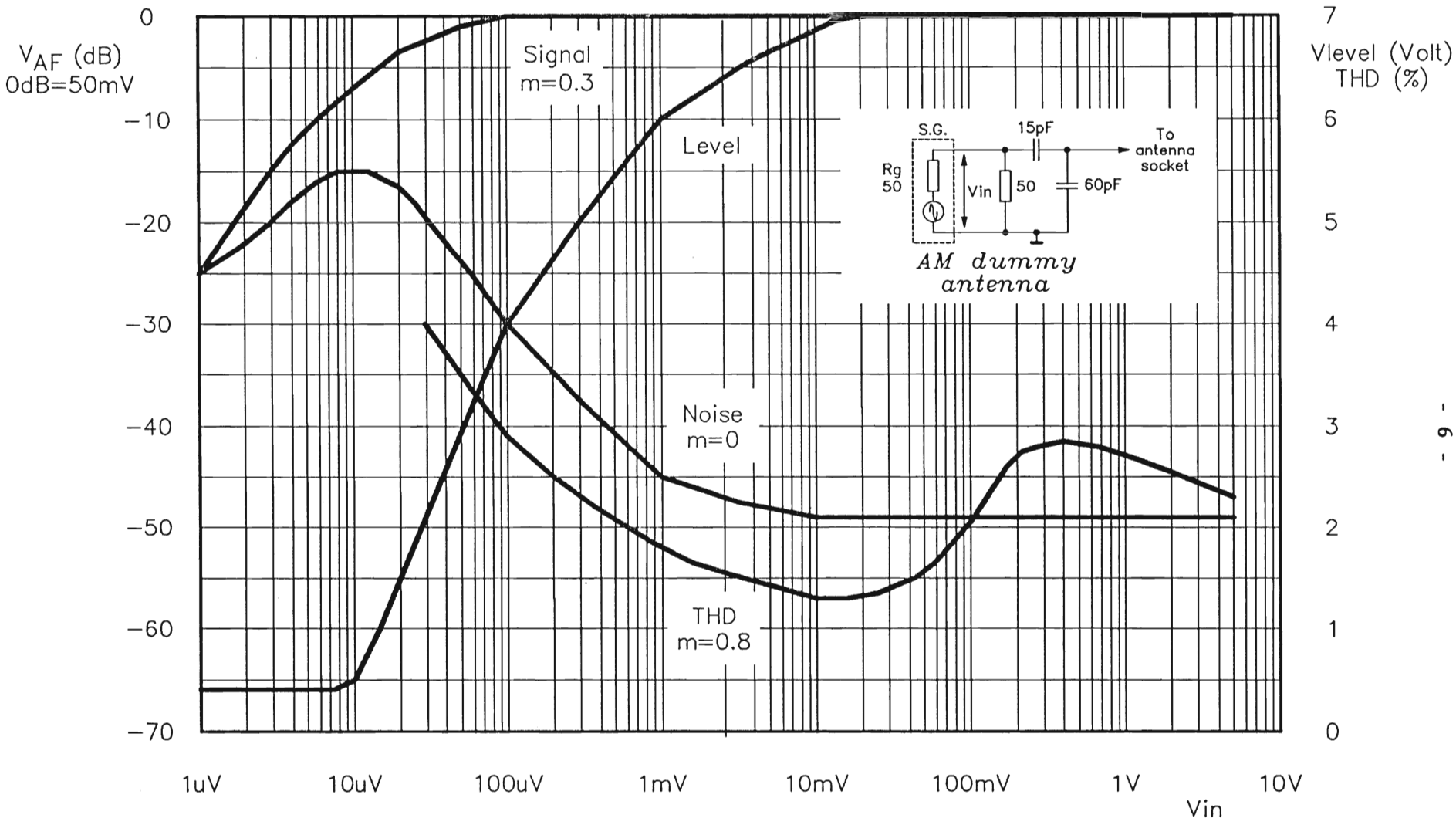
January 1991




K2
SFE10.7MS3
+8.5V
AF
LEVEL (AM/FM)
K4
SFZ468HL3
K3
CDA
10.7
MC1
C4
22
nF
C5
100
uF
C6
22
nF
C7
22
nF
R5
22k
C8
22
nF
L3
C10
180pF
AM-IF
C9
33uF
+AM
R4
56
+FM
6
7
8
9
10
11
12
13
14
15
16
TEA5594
27
26
25
24
23
22
21
20
19
18
17
R8
1.8k
C17
100
nF
+AM
R13
100
C20
100nF
C21
33uF
C22
100nF
C23
10nF
C24
10nF
C25
10nF
COUNT
ENABLE
IF
AM/FM
AM
OSC
FM
OSC
L6
VC
R14
560k
C27
1nF
C29
390pF
L5
L4
R12
47k
C26
3.3pF
CT1
40pF
VC5
BB112
-OSC
C28
1nF
AM-OSC
+AM
R22
56
R23
56
+8.5V
R24
2.2k
C39
22nF
T4
BF410A
C38
100pF
C48
10nF
G
D
S
R25
330k
R26
220
T6
BC558C
+FM (pin8)
0V = AM
5V = FM
R28
22k
T7
BC548C
+AM (pin24)
ELECTRONIC AM/FM SWITCH
AM
8.8V - 7.9V
Fcnt. 531-1602 kHz
Fosc. 999-2070 kHz
R27
4.7k
VC
TUNING VOLTAGE
C44
C45
22nF
FM
1.7V - 8.4V
Fcnt. 87.5 - 108 MHz
Fosc. 98.2 - 118.7 MHz

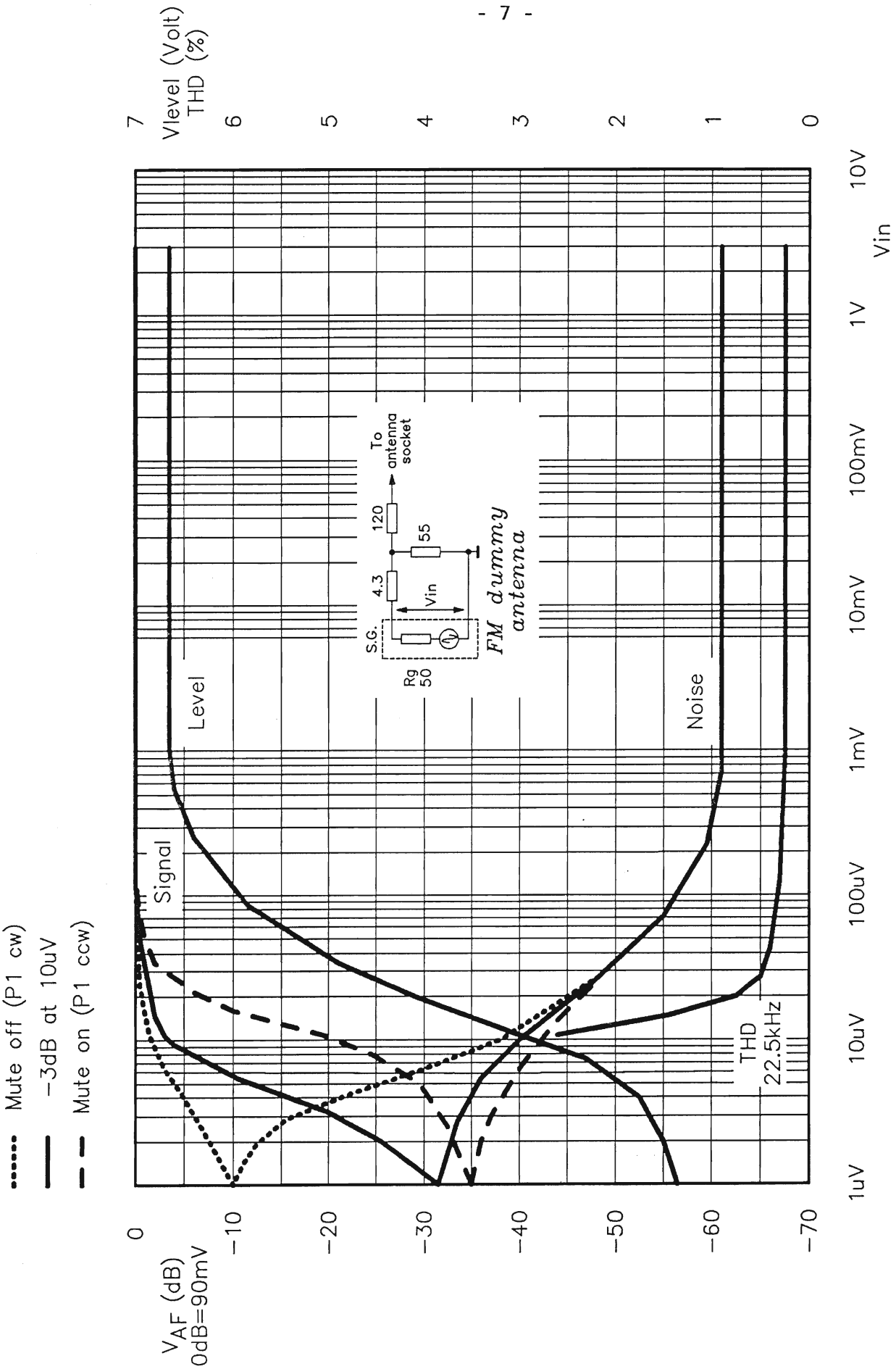

PHILIPS
JB
CSG NIJMEGEN
TEA5594
BASIC APPLICATION
Vtune
GND
Count enable
IF am fm
AMosc
FMosc
GND
AF
LEVEL
< FM
AM >
+8.5V GND
TEA5594
ANT SOCKET
LO DX
VC1
CT1
VC2
VC3
VC4
VC5
CT2
CT3
L1
L2
L3
L4
L5
L6
L7
L8
L9
L10
L11
T1
T2
T3
T4
T5
T6
T7
D1
D2
D3
D4
C1
C11
C21
C34
C41
C44
C5
C9
K1
K2
K3
K4
P1
R21
16
17
32


R15
C37
R22
R24
C38
C30
C31
C33
C36
R25
R26
C40
R16
R19
R17
C35
C32
R18
R20
C42
C43
C39
R23
C12
C13
C15
R6
R29
C14
R8
R7
C3
R9
R10
C16
R0
C17
C18
C19
C4
R3
R2
C20
C28
C22
C27
R11
R12
C26
R4
R1
C8
R13
R5
C29
R14
C45
C23
C25
R27
R28



TEA5594 Basic application

AM performance at 1 MHz



TEA5594 Basic application

FM performance at 100 MHz

S/N-Ratio: 26 dB S/N-Ratio: 26 dB S/N-Ratio: 26 dB

Alignment precedure TEA5594 basic application board.

AM alignments:

1) Connect:
   - a 8.5 V Supply Voltage
   - a variable Tuning Voltage (ranging from 0 - 8.5 Volt)
   - an RF signal generator via the AM dummy antenna to the antenna socket
   - a frequency counter to the buffered AM oscilator output (≤10 pF)
   - an oscilloscope and Sennheiser level meter to the AF output.

   Check if the AM/FM switch is in the AM position.

2) Make the Tuning Voltage 0.8 Volt.

3) Adjust L4 for a 999 kHz reading.

4) Make the Tuning Voltage 7.9 Volt.

5) Adjust CT1 for a 2070 kHz reading.

6) Repeat steps 2) to 5) till Fosc is within 1 kHz.

7) Connect the frequency counter to the buffered IF signal and connect count enable to +8.5V.

8) Inject an RF signal of 648 kHz (≈ 20 μV, 30% AM, Fmod.= 1 kHz).

9) Tune the receiver maximally to this signal (with the Tuning Voltage). The counter should give a 468 kHz reading.

10) Adjust L3 for a maximum AF reading.

11) Adjust L7 for a maximum AF reading.

12) Inject an RF signal of 1494 kHz.

13) Tune the receiver maximally to this signal (with the Tuning Voltage). The counter should give a 468 kHz reading.

14) Adjust CT2 for a maximum AF reading.

15) Repeat steps 8) to 14) till the AF maximum reading is within 1 dB. Note: It is only necessary to adjust L3 once.

16) Inject an RF signal of 1 MHz, 80 μV, 30% AM, Fmod.= 1 kHz.

17) Tune the receiver maximally to this signal (with the Tuning Voltage). The Tuning Voltage should be approx. 4.4 Volt. The counter should give a 468 kHz reading.

18) Check the Signal to Noise ratio at 80 μV. This should be approx. 26 dB.

FM alignments:

101) - change the AM dummy antenna by the FM dummy antenna
- connect the frequency counter to the buffered FM oscilator (≤10pF)
- select FM by means of the AM/FM switch
- turn P1 clock wise (mute off).

102) Make the Tuning Voltage 8.4 Volt.

103) Adjust L5 for a 118.7 MHz reading.

104) Connect the frequency counter to the buffered IF signal and connect count enable to +8.5V.

105) Inject an RF signal of 100 MHz (≈ 20 μV, F = 22.5 kHz, Fmod.= 1 kHz).

106) Tune the receiver maximally to this signal (with the Tuning Voltage). The Tuning Voltage should be approx. 4.4 Volt.

107) Adjust L1 for a maximum AF reading.

108) Adjust L6 for a maximum AF reading (CT3 min.).

109) Adjust L2 for a maximum AF reading.

110) Repead steps 106) to 109) with a RF generator signal of 5 μV.

110) Check the Signal to Noise ratio at 6 μV.
This should be approx. 26 dB.

111) Make the RF amplitude 1 mV.

112) Adjust the Sennheiser to 0 dB (approx. 90 mV).

113) Make the RF amplitude 10 μV.

114) Adjust the Sennheiser to -3 dB with P1.

Partslist application PCB TEA 5594

Part Nr.	Description	12NC	Used in	Part Nr. service doc.
L1	FM aerial	4822 156 10666	22DC550	5050 Modified !
L2	FM-IF	4822 156 21167	22AC740	5055
		3122 118 20562	TOKO sample NR.	119BCS-A6515BQG
L3	AM-IF		TOKO sample NR.	A7MCS-11213N
L4	AM-osc	3111 118 24083	TOKO sample NR.	7PSLN-1627X-S
L5	FM-osc	3112 300 50151	TOKO sample NR.	A294SNS-1121IB
L6	FM-RF	4822 156 11086	22DC552	5002
			TOKO sample NR.	E520HNS-4000023
L7	AM aerial	4822 157 51505	22DC550	5059
L8	Choke 8 mH	4822 157 51508	22DC550	5058
L9	AM-RF 330 uH	4822 157 51509	22DC550	5057
L10	Choke 5.6 uH	4822 157 51216	22DC550	5055
L11	AM-RF 1 mH	4822 157 52047	22DC550	5056
T1	BC548C	4822 130 44196	22AC744	7844
T2	BC548C	4822 130 44196	22AC744	7844
T3	BF410D	4822 130 41697	22DC550	6061
T4	BF410A	5322 130 44905	22DC550	6063
T5	BC549C	5322 130 44246	22AC844	T427
T6	BC558C	5322 130 60068		
T7	BC548C	4822 130 44196	22AC744	7844
VC1	BB204B	4822 130 34449	22DC550	6083
VC2	BB204B	4822 130 34449	22DC550	6084
VC3	BB204G	5322 130 34825	22DC550	6085
VC4	BB112	4822 130 32227	22DC550	6093
VC5	BB112	4822 130 32227	22DC550	6094
D1	1N4148	4822 130 30621	22AC750	6288
D2	1N4148	4822 130 30621	22AC750	6289
D3	BA317	4822 130 30847	22DC550	6091
D4	BA317	4822 130 30847	22DC550	6092
K1	SFE10.7MS3	4822 242 70665	22DC550	1056
K2	SFE10.7MS3	4822 242 70665	22DC550	1057
K3	CDA10.7MC1	not yet available	(100pcs in stock)	
K4	SFZ468HL3	not yet available	(100pcs in stock)	
CT1	TRIMMER 40pF	4822 125 50092	22DC550	2083
CT2	TRIMMER 40pF	4822 125 50092	22DC550	2121
CT3	TRIMMER 10pF	4822 125 50199	22DC550	2057
A1	ANT.SOCKET	4822 267 30883	22DC681	0430
P1	2K2 Potm.	4822 100 11212	22DC681	3221

Resistors (size 1206):

R0	=	1.8 kΩ
R1	=	5.6 kΩ
R2	=	3 kΩ
R3	=	0 Ω
R4	=	56 Ω
R5	=	22 kΩ
R6	=	56 kΩ
R7	=	10 kΩ
R8	=	47 kΩ
R9	=	56 kΩ
R10	=	47 kΩ
R11	=	56 kΩ
R12	=	47 kΩ
R13	=	100 Ω
R14	=	560 kΩ
R15	=	47 kΩ
R16	=	5.6 kΩ
R17	=	1 MΩ
R18	=	150 Ω
R19	=	330 kΩ
R20	=	39 kΩ
R21	=	560 kΩ
R22	=	56 Ω
R23	=	56 Ω
R24	=	2.2 kΩ
R25	=	330 kΩ
R26	=	220 Ω
R27	=	4.7 kΩ
R28	=	22 kΩ
R29	=	0 Ω

Capacitors (up to 100 nF size 1206; * = size 0805):

C1	=	4.7 µF
C2	=	68 pF
C3	=	10 nF
C4	=	22 nF
C5	=	100 µF
C6	=	22 nF
C7	=	22 nF
C8	=	22 nF
C9	=	33 µF
C10	=	180 pF
C11	=	8.2 pF
C12	=	10 pF
C13	=	3.3 pF
C14	=	1 nF
C15	=	10 nF
C16	=	100 nF
C17	=	100 nF
C18	=	1 nF
C19	=	1 nF
C20	=	100 nF
C21	=	33 µF
C22	=	100 nF
C23	=	10 nF
C24	=	10 nF
C25	=	10 nF
C26	=	3.3 pF*
C27	=	1 nF*
C28	=	1 nF*
C29	=	390 pF
C30	=	1.2 nF
C31	=	10 nF
C32	=	39 pF
C33	=	10 nF
C34	=	2.2 µF
C35	=	2.7 nF
C36	=	33 nF
C37	=	22 nF
C38	=	100 pF
C39	=	22 nF
C40	=	10 nF
C41	=	47 µF
C42	=	10 nF
C43	=	10 nF
C44	=	4.7 µF
C45	=	22 nF

Philips Components – a worldwide company

Argentina: PHILIPS ARGENTINA S.A.,
Div. Philips Components, Vedia 3892, 1430 BUENOS AIRES,
Tel. (01) 541-4261.

Australia: PHILIPS COMPONENTS PTY Ltd, 11 Waltham Street,
ARTARMON, N.S.W. 2064, Tel. (02) 439 3322.

Austria: ÖSTERREICHISCHE PHILIPS INDUSTRIE G.m.b.H.,
UB Bauelemente, Triester Str. 64, 1101 WIEN,
Tel. (0222) 60 101-820.

Belgium: N.V PHILIPS PROF. SYSTEMS – Components Div.,
80 Rue Des Deux Gares, B-1070 BRUXELLES,
Tel. (02) 525 61 11.

Brazil: PHILIPS COMPONENTS (Active Devices)
Av. das Nacoes Unidas, 12495-SAO PAULO-SP,
CEP 04578, P.O. Box 7383, Tel. (011) 534-2211.
PHILIPS COMPONENTS (Passive Devices & Materials)
Av. Francisco Monteiro 702, RIBEIRAO PIRES-SP,
CEP 09400, Tel. (011) 459-8211.

Canada: PHILIPS ELECTRONICS LTD., Philips Components,
601 Milner Ave., SCARBOROUGH, Ontario, M1B 1M8,
Tel. (416) 292-5161.
(IC Products) SIGNETICS CANADA LTD.,
1 Eva Road, Suite 411, ETOBICOKE, Ontario, M9C 4Z5,
Tel. (416) 626-6676.

Chile: PHILIPS CHILENA S.A., Av. Santa Maria 0760, SANTIAGO,
Tel. (02) 77 38 16.

Colombia: IPRELENSO LTDA., Carrera 21 No. 56-17, BOGOTA,
D.E., P.O. Box 77621, Tel. (01) 249 76 24.

Denmark: PHILIPS COMPONENTS A/S, Prags Boulevard 80,
PB1919, DK-2300 COPENHAGEN S, Tel. 01-54 11 33.

Finland: PHILIPS COMPONENTS, Sinikalliontie 3,
SF-2630 ESPOO, Tel. 3580-50 261.

France: PHILIPS COMPOSANTS, 117 Quai du Président
Roosevelt, 92134 ISSY-LES-MOULINEAUX Cedex,
Tel. (01) 40 93 80 00.

Germany (Fed. Republic): PHILIPS COMPONENTS UB der
Philips G.m.b.H., Valvo Haus, Burchardstrasse 19,
D-2 HAMBURG 1, Tel. (040) 3296-0.

Greece: PHILIPS HELLENIQUE S.A., Components Division,
No. 15, 25th March Street, GR 17778 TAVROS,
Tel. (01) 4894 339/4894 911.

Hong Kong: PHILIPS HONG KONG LTD., Components Div.,
15/F Philips Ind. Bldg., 24-28 Kung Yip St., KWAI CHUNG,
Tel. (0)-4 245 121.

India: PEICO ELECTRONICS & ELECTRICALS LTD.,
Components Dept., Band Box Building,
254-D Dr. Annie Besant Rd., BOMBAY – 400025,
Tel. (022) 493 0311/493 0590.

Indonesia: P.T. PHILIPS-RALIN ELECTRONICS,
Components Div., Setiabudi II Building, 6th Fl.,
Jalan H.R. Rasuna Said (P.O. Box 223/KBY) Kuningan,
JAKARTA 12910, Tel. (021)-51 78 95.

Ireland: PHILIPS ELECTRONICS (IRELAND) LTD.,
Components Division, Newstead, Clonskeagh, DUBLIN 14,
Tel. (01) 69 33 55.

Italy: PHILIPS S.p.A., Philips Components,
Piazza IV Novembre 3, I-20124 MILANO, Tel. (02) 67 52 1.

Japan: PHILIPS JAPAN LTD., Components Division,
Philips Bldg. 13-37, Kohnan 2-chome, Minato-ku, TOKYO 108,
Tel. (03) 740-5028.

Korea (Republic of): PHILIPS ELECTRONICS (KOREA) LTD.
Components Division, Philips House, 260-199 Itaewon-dong,
Yongsan-ku, SEOUL, Tel. (02) 794-5011.

Malaysia: PHILIPS (MALAYSIA) SDN BHD, Components Div.,
3 Jalan SS15/2A SUBANG, 47500 PETALING JAYA,
Tel. (03) 734 55 11.

Mexico: PHILIPS COMPONENTS, Paseo Triunfo de la Republica,
No 215 Local 5, Cd. Juarez CHIHUAHUA 32340 MEXICO
Tel. (16) 18-67-01/02.

Netherlands: PHILIPS NEDERLAND B.V., Marktgroep
Philips Components, Postbus 90050, 5600 PB EINDHOVEN,
Tel. (040) 78 27 49.

New Zealand: PHILIPS NEW ZEALAND LTD.,
Components Division, 110 Mt. Eden Road, C.P.O. Box 1041,
AUCKLAND, Tel. (09) 605-914.

Norway: NORSK A/S PHILIPS, Philips Components, Box 1,
Manglerud 0612, OSLO, Tel. (02) 68 02 00.

Pakistan: PHILIPS ELECTRICAL CO. OF PAKISTAN LTD.,
Philips Markaz, M.A. Jinnah Rd., KARACHI-3, Tel. (021) 72 57 72.

Peru: CADESA, Carretera Central 6.500, LIMA 3, Apartado 5612,
Tel. 51-14-35 00 59.

Philippines: PHILIPS INDUSTRIAL DEV. INC.,
2246 Pasong Tamo, P.O. Box 911, Makati Comm. Centre,
MAKATI-RIZAL 3116, Tel. (02) 868 961 to 69.

Portugal: PHILIPS PORTUGUESA S.A.R.L., Av. Eng. Duarte
Pacheco 6, 1009 LISBOA Codex, Tel. (019) 68 31 21.

Singapore: PHILIPS SINGAPORE, PTE LTD., Components Div.,
Lorong 1, Toa Payoh, SINGAPORE 1231, Tel. 350 2000.

South Africa: S.A. PHILIPS PTY LTD., Components Division,
JOHANNESBURG 2000, P.O. Box 7430.

Spain: PHILIPS COMPONENTS, Balmes 22,
08007 BARCELONA, Tel. (03) 301 63 12.

Sweden: PHILIPS COMPONENTS, A.B., Tegeluddsvägen 1,
S-11584 STOCKHOLM, Tel. (0)8-782 1 000.

Switzerland: PHILIPS A.G., Components Dept.,
Allmendstrasse 140-142, CH-8027 ZÜRICH, Tel. (01) 488 22 11.

Taiwan: PHILIPS TAIWAN LTD., 581 Min Sheng East Road,
P.O. Box 22978, TAIPEI 10446, Taiwan, Tel. 886-2-5005899.

Thailand: PHILIPS ELECTRICAL CO. OF THAILAND LTD.,
283 Silom Road, P.O. Box 961, BANGKOK,
Tel. (02) 233-6330-9.

Turkey: TÜRK PHILIPS TICARET A.S., Philips Components,
Talatpasa Cad. No. 5, 80640 LEVENT/ISTANBUL,
Tel. (01) 179 27 70.

United Kingdom: PHILIPS COMPONENTS LTD.,
Mullard House, Torrington Place, LONDON WC1E 7HD,
Tel. (01) 580 6633.

United States: (Colour picture tubes – Monochrome & Colour
Display Tubes) PHILIPS DISPLAY COMPONENTS COMPANY,
1600 Huron Parkway, P.O. Box 963, ANN ARBOR,
Michigan 48106, Tel. 313/996-9400.
(IC Products) SIGNETICS CORPORATION, 811 East Arques
Avenue, SUNNYVALE, CA 94088-3409, Tel. (408) 991-2000.
(Passive Components, Discrete Semiconductors, Materials
and Professional Components) PHILIPS COMPONENTS,
Discrete Products Division, 2001 West Blue Heron Blvd.,
P.O. Box 10330, RIVIERA BEACH, Florida 33404,
Tel. (407) 881-3200.

Uruguay: PHILIPS COMPONENTS, Coronel Mora 433,
MONTEVIDEO, Tel. (02) 70-4044.

Venezuela: IMAGNETICA S.A., Calle 6, Ed. Las Tres Jotas,
CARACAS 1074-A, App. Post. 78117, Tel. (02) 241 7509.

Zimbabwe: PHILIPS ELECTRICAL (PVT) LTD.,
62 Mutare Road, HARARE, P.O. Box 994, Tel. 47211.

For all other countries apply to: Philips Components Division,
Strategic Accounts and International Sales, P.O. Box 218,
5600 MD EINDHOVEN, The Netherlands, Telex 35000 phtcnl,
Fax. 23753

AX80

© Philips Export B.V. 1990

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner.

The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

Printed in The Netherlands

Philips Components

PHILIPS

PHILIPS